

Endogenous Growth and Human Capital: A Comparative Study of Pakistan and Sri Lanka

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I. INTRODUCTION

Economic Growth has posed an intellectual challenge ever since the beginning of systematic economic analysis. Adam Smith claimed that growth was related to division of labour, but he did not link them in a clear way. After that Thomas Malthus developed a formal model of a dynamic economic growth process in which each country converge toward stationary per-capita income. According to this model, death rates fall and fertility rises when income exceed the equilibrium, and opposite occur when incomes are less than that level. Despite the influence of the Malthusian model in nineteenth century economists, fertility fell rather than rose as income grew during the past 150 years in the west and other parts of the world.

The Neoclassical growth model of Solow (1956), which has been for the past thirty years the central framework to account for economic growth, focuses on exogenous technical population factors that determine output-input ratios, responded to the failure of Malthusian model.

Neither Malthus's nor the Neoclassicists approach to growth pays much attention to Human Capital. Yet the evidence is quite strong of close link between investments in human capital and economic growth. Since human capital embodied knowledge and skills, and economic development depends on advances in technological and scientific knowledge, development presumably depends on the accumulation of human capital. Investment in human capital has been a major source of economic growth in advanced countries. The negligible amount of human investments in underdeveloped countries has done a little to extend the capacity of people to meet the challenge of accelerated development.

Schultz (1961) noted that the growth rate of output exceeded the growth rate of relevant input measures (employment and physical capital) suggesting that

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investment in human capital is probably the major explanation for this difference. Uzawa (1965) and Rosen (1976) also stress the importance of human capital in driving economic growth. Nelson and Phelps (1966) said that the ability of nation to adopt and implement new technology from abroad is function of its domestic human capital stock.

Recent models of economic growth such as Romer (1986) and Lucass (1988) emphasise that investment in human capital an important factor contribution to economic growth. These models generate persistent growth endogenously from the actions of the individuals in the economy. An additional role for human capital may as engine for attracting other factors such as physical investment, which also contribute measurably to per-capita income growth. Recent experience with attempts to accumulate physical capital at a rapid rate in poor countries bears out the necessity of due attention to human capital because it has become evident that the effective use of physical capital itself dependent on human capital. If there is under-investment in human capital, the rate at which additional physical capital can be productively utilised is limited since technical, professional, and administrative people are needed for the effective use of physical capital. Lucass (1990) suggested that physical capital fail to flow to poor countries because of their relatively poor endowments of complementary human capital.

The large proportion of empirical evidence on the effect of human capital on growth are studies that use data on cross-section of countries and try to link some initial level of human capital with subsequent real output growth. In general, the results from the existing theoretical models suggest a positive impact of human capital on real growth. However, the individual empirical studies, though they provide numerous intriguing findings, differ substantially on their predictions, there is no consensus on the overall implications of the results.¹

There are number of drawbacks to current implementation of cross-country analysis, as pointed by Tallman and Wang (1994). Levine and Renelt (1992) perform sensitivity analysis on the observed correlation between long run growth and policy variables in cross-country analysis. Their results suggest that regression that displays a positive relationship between human capital and economic growth are not robust to the inclusion of other relevant variables. They recommend a reasonable degree of skepticism about inferences from empirical studies linking human capital to growth.

¹For example, Barro (1990a) and Mankiw, *et al.* (1992) investigates the impact of the human capital level on subsequent economic growth using cross-country analysis. Barro finds that primary school enrolment rates have significant explanatory power in the (per-capita) output regression, but the same enrolment measures for 1950 or 1970 have no predictive value. Mankiw, *et al.* find a significant role of human capital measured by the secondary school enrolment rates, but find production to exhibit diminishing returns to physical and human capital inputs.

Moreover, cross-country studies may fail to capture important country specific characteristics that may be crucial to their economic development.² So despite of the growing literature, the results of the existing cross-country studies present conflicting evidence so that the explicit effect on output growth from human capital remain inconclusive.

In fact, there are certain advantages of analysing growth in a comparative study framework. For example, (a) a more careful and in-depth examination of institutional and historical characteristics of a particular country; (b) the use of data set comprised of the most appropriate and highest quality measures unconstrained by the need for measurement consistency across countries; and (c) a more detailed exposition of the dynamic evolution of the economy; and (d) provide a comparative analysis.

Moreover, a lot of work has done for developed countries, a very little attention has been given to developing nations. Therefore, the present paper adopts an alternative empirical strategy to investigate the importance of human capital on economic growth by focusing on two developing countries i.e., Pakistan, and Sri Lanka for a comparative analysis.

The main objectives of this study are to (1) Estimate and analyse the effects of human capital on economic growth for five the countries in the sample. (2) Estimate and analyse the effects of effective labour input on economic growth. (3) And finally, recommend some policy implications for each country in the sample.

The study is divided into six section. In Section II, we discuss the main sources of data and its limitations. In Section III the framework of the study is explained. In Section IV of the study, Empirical Analysis is discussed. In Section V, concluding remarks and policy implication are given. Finally, in Section VI of the study references are quoted.

Basic Concepts and Definitions Employed in the Study

The Concept of Human Capital

Although, the theory of human capital has been in the economic and statistical literature for almost 300 years, yet the floodgates were opened by Schultz (1961); Becker (1962) and Mincer (1974). So one of the them who has done pioneer work in this field, explained investment in human capital follows:

Although it is obvious that people acquire useful skills and knowledge, it is not obvious that these skills and knowledge are form of capital, that this capital is in substantial part a product of deliberate investment, that it has grown in western

²In the presence of multiple steady states and multiple convergence groups [see a discussion in Becker, Murphy, and Tamura (1990) and Tamura (1981)], cross-country analysis is generally subject to sample selection bias [see comment by De Long (1989), on Bauml].

societies at a much faster rate than conventional (non-human) capital and that this growth may well be the most distinctive feature of the economic system'.³

The so-called human capital revolution in economic thought rests on the proposition that persons enhance their capabilities as producers and consumers by investment in themselves. The direct benefit of such investment is estimated as at least as large and as "profitable" as investment in tangible capital. It has been widely observed that increase in national output have been large as compared with the increase of land, man-hours, and reproducible capital. Investment in human capital is probably the major explanation for this difference.

Much of what we call consumption constitutes investment in human capital. Direct expenditures on education, health, and internal migration to take advantage of better job opportunities are clear examples. Earning foregone by mature students attending school and by the workers acquiring on-the-job training are equally clear examples.

There are several empirical puzzles that have failed to be explained adequately or else have been "explained" by various adhoc theories of labour market. Becker subsequently shows how human capital theory provides a consistent explanation of each of these observations. These puzzles include:

- (1) Earnings increases with work experience at decreasing rate.
- (2) The rate of unemployment is negatively related to the level of skill.
- (3) Young people change job more often and receive more schooling and training on the job than do older.
- (4) In developing countries, firms often appear to treat their labour force paternalistically.
- (5) People with more ability usually receive more education and training than less able persons.
- (6) Inequality and asymmetry in the earning distribution within schooling groups tends to increase the level of education.

Natural resources, physical capital, and raw labour are not sufficient in developing a highly productive economy. A wide array of human skills is essential in fueling the dynamics of development. Without them, the economic prospects are bleak. Many experts over rate the necessity of having natural resources on national territory. The economic success of the early Mediterranean cities, states, of the free cities of Northern Europe, and currently of Hong Kong and Singapore, do not support this need. Nor do not the economic successes that Denmark, Switzerland, and Japan have achieved. The development and transmission of practical knowledge and intellectual skills are at the heart of economic development, observing that:

³Schultz (1961) "Investment in Human Capital" reprinted in *The Goal of Economic Growth* (ed. E.S. Phelps), p. 106. compare also Schultz, *The Economic Value of Education*.

... A dynamic economy can be launched and sustained only through the efforts of man at all social levels that embody both conventional learning and technical manipulative skills—including specifically skill in the decoding of instructions and the “debugging” of new process. A complex economy rests on widely diffused tools for communication, storage, and retrieval of knowledge.⁴

Some Effects of Human Capital

Difference in earnings among persons, areas, or time period are usually said to result from difference in physical capital, technological knowledge, ability, or institutions (such as unionisation or socialised production). The previous discussion indicates, however, that investment in human capital has also an important effect on observed earnings because earnings tend to be net of investment costs and gross of investment returns. Indeed, the appreciation of the direct and indirect importance of human capital appears to resolve many otherwise puzzling empirical findings about earnings. For examples:

- (1) Almost all studies show that age-earnings profiles tend to be steeper among more skilled and educated persons. For since observed earnings are of gross of returns and net of costs, investment in human capital at younger age would reduce observed earnings then and raise them at a latter age, thus steeping the age-earnings profiles. Likewise, investment in human capital would make the profile more concave.⁵
- (2) In recent years students international trade theory have been somewhat shaken by finding that the United States, said to have relative scarcity of labour and abundance of capital, apparently exports relatively labour-intensive commodities and imports capital-intensive commodities. For example, one study found that export industries pay higher wages than the import-competing ones.⁶

An interpretation consistent with Ohlin-Heckscher emphasis on the relative abundance of different factors argues that the United States has even more (relatively) abundant supply of human capital than of physical capital. An increase in human capital would, however, shows up as an apparent increase in labour intensity since earnings are gross of the returns on such capital. Thus export industries might pay higher wages than

⁴C. Arnold Anderson and Mary Jean Bowman “Education and Economic Modernisation in Historical Perspective”, in *schooling and society: study in the history of education*, ed. Lawrence Stone (Baltimore: Johns Hopkins University Press, 1976, pp. 3–19).

⁵G. S Becker, *Human Capital: A theoretical and empirical analysis, with special reference to education*. Second edition NBER, Columbia University Press, New York, 1975.

⁶See I. Kavis, “Wages and Foreign Trade”. *Review of Economics and Statistics*. February, 1956.

import-competing ones primarily because they employ more skilled or healthier workers.⁷

- (3) A secular increase in average earnings has usually been said to result from increase in technological knowledge and physical capital per earner. The average earner, in effect, is supposed to benefit indirectly from activities by entrepreneurs, investors, and others. Another explanation put forwarded in recent years argued that earning could rise because of direct investment in earner.⁸

Incorporating Human Capital in Growth Equations

The existing literature contains a number of different conceptual rationales for the inclusion of human capital in models of economic growth. Four of these are as follows.

- (1) Standard sources-of-growth equations based on a dynamic Cobb-Douglas production function can readily be extended to include human capital such that aggregate output (or output per capita) growth is function of, inter alia, of the rate of growth of human capital.
- (2) Mankiw, Romer and Weli [MRW (1992)] have recently demonstrated that an extended Solow model, solved for the equilibrium steady-state per capita income level, yields a (per capita) income growth equation with physical and human capital investment rates (i.e., ratios of GDP) entering separately among the arguments.
- (3) Romer (1990) models an endogenous growth process in which results directly from physical capital investment which in turn is driven by investment in research and development (R&D) generating ideas for 'new' designs/goods. Romer then hypothesis that the creation of these new designs/goods is a function of the stock, as well as the growth, of human capital in the form of 'basic' (as distinct from 'applied') scientific knowledge.
- (4) An alternative way of characterising the role of human capital is as a facilitating factor in the international transfer of technology (or basic scientific knowledge, in Romer (1990) case) from innovating countries to 'imitating' countries. In this case, rather than (or as well as) entering as input into production, the level of human capital affects growth by

⁷See for example, the discussion in W. Leontief, "Factor proportional and the structure of American trade: further theoretical and empirical analysis". *Review of Economics and Statistics*, November, 1956.

⁸The major figure here is T.W. Schultz, of his many articles, see especially "Education and Economic Growth" in *Social Forces Influencing American Education*, Sixtieth Yearbook of the National Society for the Study of Education, Chicago, 1961, Part II, Chapter 3.

facilitating improvements in total factor productivity via 'imported' technology.

Importance of Education as a Measure for Human Capital

The concept human capital has now dominated the economics of education and has a powerful influence on the other branches of economics. Research interest in the role of education in the process of economic development has grown in recent years. There are a variety of reasons including the following.

Most economic analysis of return from education has focused on the contribution of education to earning capacity (and presumably, to production capacity). Schooling benefits many persons other than the student. It benefits the student's future children, who receive informal education in the home; and it benefits neighbours, who may be effected favourably by the social values developed in children by the schools and even by the quietness of the neighbourhood while the school are in session. Schooling benefits employers seeking a trained labour force; and it benefits the society at large by developing the basis for an informed electorate.

In discussion, which follows, a "benefit" of education will refer to any thing that pushes outward utility possibility function for the society. Included would be (1) anything which increases production possibility, such as increased labour productivity; (2) anything which reduces costs and thereby makes resources available for more productive uses, such as increased employment opportunities, which may release resources from low employment by cutting crime rates; and (3) anything which increases welfare possibilities directly, such as development of public-spiritedness or social consciousness of one's neighbour. Anything which merely alters relative prices without affecting total utility opportunities for the group under consideration will not be deemed a social benefit. For example, if expanded education reduces the number of household servants, so those wage rates of that remaining rise, this rise would not constitute either a benefit or loss from education but rather a financial transfer.

II. DATA SOURCES AND THEIR LIMITATIONS

The major sources of the data are the World Tables and World Development Reports published by the World Bank for different years. Moreover, UNESCO Yearbooks and United Nation Asia-Pacific yearbooks for different years. The data regarding employment and labour force has been obtained from the ILO Yearbooks of Labour Statistics published by the International Labour Organisation (ILO). Furthermore, the Statistical Yearbooks and Labour Force Surveys of the relevant countries have also been sorted out. The data are annual and over the period 1970–94.

Many theoretical models of economic growth have used the schooling enrolment rates (SERs) as proxy variables for human capital. We will also use the schooling enrolment rates. Schooling enrolment ratios have several deficiencies as measure of stock of human capital. First, the current enrolment ratios measures the flows of schooling, the accumulation of these flows creates the future stocks of human capital. Because the educational process takes many years, the lag between flows and stock is very long.⁹ If the approximate lag is considered, then the construction of human capital stocks still requires an estimate of initial stocks. Errors are introduced because of mortality and migration and because the net enrolment ratios are unavailable for developing countries. The gross enrolment ratio introduces errors related to repetition of grades and dropouts, phenomena that are typically high in developing countries.¹⁰

Another problem may be that the underlying data on schooling enrolment are of doubtful quality for developing countries. Most information collected by UNESCO comes from annual surveys of educational institutions in each country. The typical practice is that the person responsible for administering each institution answers a number of questions about his or her institution. Chapman and Brothroyed (1988) note that in several countries headmasters have been observed to inflate the reported enrolment based on their experience that higher enrolment figures lead to more resource supplies, textbooks, and budget allocated to the school. Thus, in general, the reported enrolment may an upward bias.

An additional source of upward bias may be that the data refer to the registered number of students at the beginning of each school year. The actual number of children that attend the school during the year can be substantially lower. The error is particularly serious for developing countries in which government punishes parents that do not register their children at primary schools.

III. FRAMEWORK OF THE STUDY

The objective of the study is to estimate the role of human capital in economic growth, a comparative analysis of two developing countries i.e., Pakistan, and Sri Lanka. For this purpose, method of analysis is discussed blow.

We employ the standard growth accounting methodology with human capital specifies an aggregate production function in which Gross Domestic Product (GDP) Y_t is the dependent variable, three input factors i.e., employment L_t , physical capital K_t , and human capital H_t are the independent variables.

The growth model used in the study is

⁹See Psacharopoulos and Ariagada (1986), pp.1-2, for discussion.

¹⁰For the total of developing countries in 1980, Fredriksen (1983) estimates that the average gross enrolment ratio at the primary level was 85 percent. The elimination of repeaters reduces the estimated value to 73 percent.

$$Y_t = A_t K_t^\alpha L_t^\beta H_t^\gamma e_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

Where A_t = exogenous level of technology.

K_t = gross domestic investment (a proxy variable for physical capital).

L_t = employment.

e_t = error term.

Crucial to our analysis is the assumption that rates of return on investment in human capital rise rather than decline as stock of human capital increases, at least until the stock becomes large. So it is notable that there are constant return to scale in three reproducible (physical, labour and human) capital stocks (i.e., $\alpha + \beta + \gamma = 1$ or (1), the model generate perpetual growth.

Taking log of (1), the relationship for growth can be expressed as

$$\log Y_t = \log A_t + \alpha \log K_t + \beta \log L_t + \gamma \log H_t + \log e_t \quad \dots \quad \dots \quad (2)$$

$$\log Y_t = a + \alpha \log K_t + \beta \log L_t + \gamma \log H_t + e_t \quad \dots \quad \dots \quad (3)$$

Where $\log A_t = a$, $\log e_t = e_t$

Because of data constraints, we use proxy variables relevant to growth accounting by those, which are directly observable. For example, although physical capital are necessary to estimate the growth accounting equations, the literature has usually used gross investment rates as a proxy variable for physical capital accumulation [Barro (1991)]. So in our study we use gross domestic investment as a proxy variable for physical capital. In addition, human capital has been proxied in the literature by schooling enrolment rates. Therefore, in this part of the study we use schooling enrolment rates as proxies for human capital.

The three main proxies for human capital that we use are the values of schooling enrolment rates at the higher, secondary, and primary level. These schooling rates are obtained by the number of students enrolled in the designated grade levels relative to the total population of corresponding age groups i.e.,

Gross Enrolment = total enrolment in the designated grade (total population of the corresponding age group).

Thus, alternatively, we estimate the following three equations for each country in the sample.

$$\log Y_t = a + \alpha \log K_t + \beta \log L_t + \gamma \log he_t + e_t \quad \dots \quad \dots \quad (4)$$

$$\log Y_t = a + \alpha \log K_t + \beta \log L_t + \gamma \log se_t + e_t \quad \dots \quad \dots \quad (5)$$

$$\log Y_t = a + \alpha \log K_t + \beta \log L_t + \gamma \log pe_t + e_t \quad \dots \quad \dots \quad (6)$$

Where he_t = schooling enrolment rate at higher level of education at t years
($t = 1, 2, \dots, 25$)

se_t = schooling enrolment rate at secondary level of education at t years
($t = 1, 2, \dots, 25$)

pe_t = schooling enrolment rate at primary level of education at t years
($t = 1, 2, \dots, 25$).

Moreover, we will combine schooling enrolment rates at different level of education and employment to create effective labour input. Because we know that human embodied effective labour performs better than traditional employment in estimating potential output growth. So aggregate production function of (1) can be written in the following form.

$$Y_t = A_t K_t^\alpha (L_t H_t)^\beta e_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (7)$$

Taking log of (7), we have

$$\log Y_t = \log A_t + \alpha \log K_t + \beta (\log L_t + \log H_t) + \log e_t \quad \dots \quad \dots \quad (8)$$

$$\log Y_t = a + \alpha \log K_t + \beta (\log L_t + \log H_t) + e_t \quad \dots \quad \dots \quad \dots \quad (9)$$

Equation (9) will be estimated at all educational levels i.e., primary, secondary, and higher for both countries.

Hypotheses of the Study

In our empirical analysis i.e., the growth accounting with human as a factor of production, we will estimate the standard growth accounting model. In the literature human capital is considered as the engine of growth. For example, Romer (1990) found that countries with greater initial stock of human capital experience a more rapid rate of introduction of goods and thereby to grow faster. Becker, Murphy, and Tamura (1990), assume that the rate of return on human capital increases over some range, an effect that could arise because of the spillover benefits from human capital that Lucas (1988) stresses. As an example, the return to kind of ability, such as talent in communications is higher if other people are more able. In this setting, increase in the quantity of human capital per person leads to higher rate of investment in human capital, and hence to higher per capita growth. Therefore, we hypothesise that the proxies for human capital in Equations (4), (5), (6), and (9) will effect positively to the growth of the economies of the selected countries.

IV. EMPIRICAL ANALYSIS: GROWTH ACCOUNTING WITH HUMAN CAPITAL AS A FACTOR OF PRODUCTION

The empirical estimates presented below provide insights into the relationships between measures of physical and human capital and growth. However, these regressions should not be misinterpreted as causality tests: in particular, we acknowledge a substantial feedback effect from output toward the input, as emphasised in the endogenous growth literature. These estimates are not simple correlations because the input measures directly impact the production process so

that the measures are related directly. Rather, we view the evidence as indicating whether our human capital proxies improve upon traditional growth measurement. Now we discuss the empirical result in detail.

Effects of Human Capital on Economic Growth, Measured by School Enrolment Rates

In this section of the study, first of all Equations (4), (5) and (6) have been estimated for both of the countries in the sample, in which schooling enrolment rate at primary level of education (SERP), secondary level of education (SERS) and higher level of education (SERH) are used as a proxy variables for human capital and the results are reported in the table given below. It should be noted that regressions were estimated by using Ordinary Least Squares (OLS) method.

Table 1 reveals that the coefficient of logGDINV is positive and significant at 0.01 level of significance for both countries. When we look at the coefficient of employment, it is positive and significant at 0.01 level of significance for Pakistan at all levels of education. Moreover, the coefficients of employment are also positive for Sri Lanka.

Table 1
*Estimated Results at Different Levels of Education—
Dependent Variable LogGDP*

Countries/Level of Education Variables	Primary		Secondary		Higher	
	Pakistan	Sri Lanka	Pakistan	Sri Lanka	Pakistan	Sri Lanka
Constant	0.322	5.842	-0.226	2.431	0.120	3.434
LogGDINV	0.453 (8.425)*	1.254 (14.262)*	0.425 (7.579)*	0.770 (11.094)*	0.440 (7.499)*	0.940 (6.646)*
Log LAB	0.554 (10.827)*	0.076	0.526 (10.896)*	-0.008	0.529 (10.396)*	0.021
Log SERS	-0.024 (-1.801)***	-0.0347 (-4.013)	0.061 (2.213)**	0.248 (4.600)*	0.042 (1.632)***	0.032 (1.534)**
R ²	0.996	0.987	0.996	0.988	0.996	0.977
F	2165.808	598.783	2313.977	681.274	2113.896	337.713
S.E	0.025	0.083	0.025	0.035	0.026	0.050

Notes: *Significant at 0.01 level of significance.

**Significant at 0.05 level of significance.

***Significant at 0.01 level of significance.

Figures in the parenthesis are estimated *t-value*.

The comparisons of the results for human capital proxy variable suggest that the coefficients of schooling enrolment at primary level are negative for both countries in the sample. As for as Pakistan is concerned, the most important reason might be that in Pakistan the poverty level is very high and most of the parents send their children to work rather than putting them in school. Moreover, the returns to primary education are very low especially in case of the urban formal sector of Pakistan. Furthermore, the partial correlation between SERP and GDP is negative i.e., -0.30 . In case of Sri Lanka we have surprising results and the possible reason may be that recently in Sri Lanka more attention has been given to promote higher education instead of primary education. The other reason might be that production function has no effect on productivity. This is because of the fact that if we run simple regression (without Cobb-Douglas production function), the coefficient of SERP is positive and statistically significant.

Regarding the assumption of the model, it is notable that in case of Pakistan and Sri Lanka both, there are constant returns to scale (i.e., $\alpha + \beta + \gamma (=1)$) which imply that the model can generate perpetual growth.

Equation (5) has been estimated using schooling enrolment rate at secondary level of education as a proxy variable for human capital and the results are reported in Table 1. It is evident from the table that gross domestic investment and employment effect positively and significantly to the growth of gross domestic product except in Sri Lanka, where employment effects negatively to GDP. The possible reason might be that the unemployment level, especially for those who are in age of attending secondary school, is very high in Sri Lanka. The other reason may be that the partial correlation between employment and SERS is negative (i.e., -0.025) which is very low. It suggests that the parents prefer to send their children to secondary schools instead of work.

When we compare the results of human capital proxy variable i.e., the schooling enrolment at secondary level, we found that SERS effect positively and significantly to the growth of the gross domestic product for both countries in the sample. These results are analogous to cross-country studies such as Barro (1991), Mankiw and Weil (1992), in which a country's subsequent growth is positively related to the measures of human capital. It implies that if there is increase in human capital accumulation, it will lead to increase in economic growth of developing countries. As for as the assumption of the model is concerned, it is found that in case of both countries, there are constant return to scale of production ($\alpha + \beta + \gamma = 1$) i.e., 1.01 and 1.01 respectively, so the model generate perpetual growth for these countries

Now Equation (6) has been estimated and the results are given in the same table. It should be noted that in this equation we have used the schooling enrolment rate at a higher level of education (SERH) as a proxy variable for human capital. It is evident from the table that logGDINV has a positive and significant impact on the growth of gross domestic product.

The table, further reveals that the coefficient of logSERH is positive and effects significantly to GDP for Pakistan and Sri Lanka. It implies that human capital has a significant contribution to economic growth for these countries. It is interesting to note that there are constant returns to scale ($\alpha + \beta + \gamma = 1$) for both countries, so when we use higher education as a proxy for human capital, the model generates perpetual growth. The main findings of this section are summarised as under:

- (a) Human capital proxied by primary schooling enrolment rates has a negative impact on growth for both countries.
- (b) Human capital measured by secondary schooling enrolment rates has a positive and significant effect on economic growth for Pakistan and Sri Lanka.
- (c) Human capital represented by higher schooling enrolment rates has a positive impact on economic growth for both countries in the sample.

Overall empirical evidence here supports the idea that human capital plays a crucial role in economic growth for these two developing countries. Moreover, treating human capital as a factor of production implies that in the growth accounting regressions, human capital effects positively and significantly especially at the secondary level of education to the growth of gross domestic product for the selected countries. Therefore, we can say that human capital has positive impact on economic growth for developing countries.

Effects of Human Capital Proxied by Effective Labour on Economic Growth

In this part of analysis, we have combined the schooling enrolment rates with employment in order to create effective labour input. As we know that human capital embodied labour performs better than raw labour. Furthermore, this measure is better as compared to simple schooling enrolment rates in estimating potential output growth. For this purpose Equation (9) has been estimated for the selected countries by using different levels of education as a human capital measures and the results are presented in Table 2.

The results in Table 2 reveals that in case of Pakistan, there is significant improvement in the share of effective labour for all the measures of human capital as compared to simple schooling enrolment rates. In case of Pakistan, for primary schooling enrolment rates, it improves from -0.024 to 0.123 and for secondary schooling enrolment, it improves from 0.061 to 0.388 , which are both significant now and finally, for higher education from 0.042 to 0.090 but it is still insignificant. It implies that for Pakistan, human capital embodied labour performs much better in estimating potential output growth as compared to simple schooling enrolment rates. It is also evident from the table that for Pakistan, $\alpha + \beta = 1$ for all the levels of education which suggest that the above model generates perpetual growth for Pakistan's economy.

Table 2

*Output Estimates and Education-enhanced Labour Input—
Dependent Variable LogGDP*

Countries	Levels of Education	Constant	Effective Labour Lab*SERs	LogGDINV	R ²	S.E	F
Pakistan	Primary	0.537 (2.688)*	0.123 (19.389)*	0.889	0.983	0.054	709.305
	Secondary	0.263	0.388 (3.933)*	0.612 (6.201)*	0.987	0.047	912.547
	Higher	1.811	0.090	0.904 (10.518)*	0.978	0.061	558.451
Sri Lanka	Primary	5.906	−0.140	1.123 (11.253)*	0.981	0.047	575.383
	Secondary	0.771	0.253 (3.204)*	0.750 (9.496)*	0.986	0.040	778.445
	Higher	3.722	0.034	0.957 (8.836)*	0.979	0.048	529.734

Notes: *Significant at 0.01 level of significance.

Figures in the parenthesis are estimated *t*-value.

In case of Sri Lanka there is also no significant improvement by using human capital proxy instead of simple schooling enrolment rates. But there are constant returns to scale (i.e., $\alpha + \beta = 1$) in the reproducible factors especially for secondary and higher education level. It implies that the effect of higher education on economic growth is more as compared to lower levels of education. This is because of the fact that in the recent years more attention has been given to promote higher education in Sri Lanka.

The main results of this part are given as under:

- Human capital embodied labour with primary level of education has positive effect on economic growth for Pakistan only.
- Human capital embodied labour with secondary level of education effect positively and significantly to growth for both countries.
- Human capital embodied labour with higher level of education has positive and significant impact on economic growth for Pakistan and only positive for Sri Lanka but not statistically significant.

So overall, by applying this measure for human capital for the selected countries during 1970–94 period suggest not only that there are important growth effects associated with human capital but also this measure out-performs the simple schooling enrolment.

V. CONCLUDING REMARKS AND POLICY IMPLICATIONS

In this paper, we made an attempt to determine empirically the role of human capital in economic growth, a comparative analysis of two developing countries. The Neoclassical growth theory suggests that growth would be negatively related to initial stock of capital. Thus one would observe a convergence of the growth paths of countries. In the recent past, economists have come with a different analysis of the growth process, where growth is an endogenous process brought by human capital accumulation.

Barro (1991) tried to determine the impact of human capital and physical capital stocks on the growth rates of the countries for the period from 1960 to 1985 in a sample of 98 countries. He found that while the initial stock of physical capital proxied by GDP in base year (GDP60) has a negative impact on growth rate, human capital measured by schooling enrolment rates in the base year (primary and secondary school enrolment in 1960) had a positive impact on growth rate. However, there are several drawbacks in trying to determine the effect of human capital so far back as 1960 on all future growth rates, which have been elaborated in the present paper.

In my study, I have tried to determine the effect of human capital on economic growth of a more recent period namely 1970 to 1994 for the selected countries. The results of empirical analysis i.e., growth accounting with human capital as a factor of production, show that human capital represented by primary schooling enrolment rates has a negative impact on economic growth for Pakistan and Sri Lanka. Human capital proxied by secondary schooling enrolment rates has a positive and significant impact on growth for both countries in the sample. Moreover, human capital measured by higher schooling enrolment rates has also a positive impact on economic growth for Pakistan and Sri Lanka. Moreover, in the other part of the analysis, I have tried another measure for human capital i.e., I have combined the human capital measures (schooling enrolment rates at different levels of education) with employment in order to create effective labour input. As we know that human capital embodied labour performs better as compared to simple schooling enrolment rates. So by applying this measure for human capital, we found that there are not only important growth effects associated with human capital, but also this measure out-performs the simple schooling enrolment rates. Therefore, overall, empirical evidence of the study supports the idea that human capital plays a crucial role in the growth of the economies for developing countries especially for these two countries. Moreover, treating human capital as a factor of production implies that in the growth accounting regressions, human capital effect the growth of gross domestic product for the selected countries.

POLICY IMPLICATIONS

Pakistan

- Greater attention should be given to the areas where the facilities of education, especially primary education, are inadequate.
- There is positive relationship between human capital measures especially at secondary and higher levels of education and economic growth. It means that if there is increase in human capital investment at these levels of education, it helps to increase economic growth. Therefore, the policy alternative should be to increase the investment in human capital for secondary and higher levels of education.
- The effect of literacy on economic growth is negative. This is due to the low literacy rates in Pakistan; therefore, the government of Pakistan should introduce policies, which increase the literacy such as education scheme for the adult population.
- Human Capital embodied labour effects positively and significantly to economic growth, so the policy alternative should be that government has to increase investments in training programmes for labour and technical education.
- The annual budget allocation for education in Pakistan is very low, so there is a need to allocate a significant amount of funds to education sector.
- There may be hindrances to the free choice of profession. Racial discrimination and religious discrimination are still widespread in Pakistan. Such hindrances keep the investment in this form of human capital investment substantially below its optimum. The policy alternative should be to reduce such kind of hindrances in the process of growth.

Sri Lanka

- There is a positive correlation between the human capital measures especially proxied by secondary and higher schooling enrolment rates and economic growth. This means that if there is an increase in investment in this form of human capital, it will help to increase growth for Sri Lanka's economy.
- Human capital measure proxied by primary schooling enrolment rates effect negatively to the growth of GDP, so the government of Sri Lanka has to introduce policies which will help to promote primary education in the country.
- There is need to improve the quality of education especially for primary and secondary levels of education, so that educated labour force can perform betterly as compared to uneducated.

- Although Sri Lanka has achieved high literacy rate in the South Asia, still there is a need to increase investment for technical education, so the policy alternative should be to increase the technical education in the country.

Some Common Policy Implications

- It is indeed to stress the greater imperfections of the capital market in providing funds for investment in human beings than for physical goods. Much could be done to reduce these imperfections by reforms in tax and banking loans and by changes in banking practices. Long term private and public loans to student are warranted.
- In most of the developing countries investment in human beings is likely to be underrated and neglected. But truly, the distinctive feature of our economic system should be the growth of human capital, without it there would be only hard, manual work and poverty, except for those who have income from property.
- A significant amount of public funds in developing countries should be allocated to education and health (for human capital formations) and research (for the production of intellectual capital).
- Education must be regarded as an important and indispensable pre requisite for sustained scientific and technological progress.
- The relatively large human capital formation must be viewed as an important cause of the more equal distribution of income.
- The community may benefit from increased investment in human capital because it improves the general “character” of society and the “quality” of economic and social decisions.
- All of these countries have large growing populations. Greater attention should be given to women’s health education, sex education, and birth control.
- Investment in human capital is important for the developing countries. Because of that, the economies with high ratios of physical to human capital will always decumulate physical capital and economies with low ratios of physical to human capital will always increase their holdings of physical capital. This places human capital as a key factor for growth.

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Comments

Beyond doubt or question, human capital plays an important role the overall economic development by enhancing the productivity of workers. Empirical evidence suggests that education and training are strongly linked to productivity and economic growth. Realising this strong relationship, many countries allocated huge budgets for human capital formation through education and training. As a result, they not only achieved high economic growth but also maintained the growth for long period of time. The experience of developed countries including United States and Japan are ready example that used human capital as essential ingredient for economic development and growth.

Based on the experience of these developed countries, a wide body of literature exists on the role of human capital in the development process and different ways through which it influences economic growth and welfare. The author has provided comprehensive survey of the existing literature on the topic and tried to establish a link between economic growth and human capital in the context of two developing countries namely Pakistan and Sri Lanka. It has also provided some policy implications for achieving the sustainable economic growth.

The paper under consideration is second in the series of papers produced by the author on the same topic. In this paper, he replaced India with Sri Lanka to see the role of human capital on economic growth. The author did not try to change even the wordings of the paper in most of the sections. The data and conclusion slightly differ and that is due to the inclusion of Sri Lanka in the model instead of India. The paper has not been improved in the light of the comments received on the earlier draft which was presented in the Seventeenth Annual General Meeting of PSDE under the title “ The Role of Human Capital in Economic Growth: A Comparative Study of Pakistan and India”.

The paper uses Cobb-Douglas production function with human capital as one of the independent variables. Human capital is measured with the help of gross enrolment which does not reflect the actual educational attainment of the population as many children drop out within one year of school enrolment. The conclusion based on this variable are, therefore, highly questionable. Instead net enrolment rate can be good proxy for human capital formation and the data on this variable is available in Pakistan and most probably in Sri Lanka as well. The author has separated the primary achievers from secondary and higher educated and growth equations are run separately for each group. One may include all these in one equation and observe the relative effect of these variables, which may present relatively interesting picture.

Author has cited studies in the review of literature which used lags of different variables as explanatory variables and these seems very relevant variables in the context of economic growth. This gives the feeling that author intends to use lags of different variables in the growth equations but these are not used in the empirical analysis. The inclusion of lags would have enhanced the predictive power of the model.

The conclusions drawn in the paper are also somewhat difficult to digest. For example, school enrolment at primary level is negative for both countries. This is in sharp contrast to the government policy, which is striving to universalise the enrolment at primary level. If enrolment at primary level is retarding the growth of the economy, then there is no justification to invest huge sums in education.

Another surprising finding of the study is the negative impact of employment on GDP growth in Sri Lanka. The reasons given in the paper are not convincing and could not explain this unexpected outcome in case of Sri Lanka. At overall level, author can improve the quality of paper in the light of these comments and the comments given on the previous draft.

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